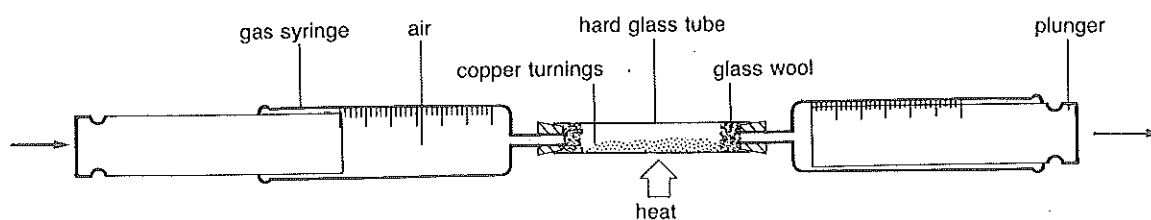
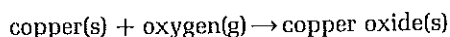


4.2 The proportion of oxygen in air



The percentage of oxygen in air can be determined by heating air with a metal that reacts with oxygen but not with the other gases. Reactive metals such as potassium, sodium and magnesium therefore cannot be used since they react with nitrogen, carbon dioxide and water.

Copper is a more suitable choice of metal.



Aim

To determine the percentage of oxygen in air.

Apparatus and materials

Three stands, bosses and clamps, or syringe holders

Two gas syringes, 100 cm³

Silica glass tubing

Bunsen burner and mat

Thick rubber tubing for connections

Glass wool

Splint

Damp cloth

Copper (produced from wire form copper oxide)

Procedure

- 1 Set up the apparatus as shown above. Push air into one syringe and record its volume.
- 2 Heat the copper using a roaring Bunsen flame.
- 3 Move the syringe plungers slowly forwards and backwards whilst the copper is heated.
- 4 Continue step 3 until there is no further change in the volume of gas.
- 5 Remove the Bunsen flame. Allow the combustion tube to stand for a few minutes and then cool with a damp cloth until the volume of the gas is constant.
- 6 Push the remaining gas into one syringe and record the volume.
- 7 Disconnect the syringe containing the gas and push it out from the syringe onto a glowing splint.

Results

volume of air at start of experiment	=.....cm ³
volume of gas at end of experiment	=.....cm ³
volume of oxygen removed	=.....cm ³

Effect of remaining gas on a glowing splint:

.....
.....

Calculation

$$\begin{aligned} \text{percentage of oxygen in air} &= \frac{\text{reduction in volume of air}}{\text{volume of air at start of experiment}} \times 100 \\ &= \text{.....}\% \end{aligned}$$

Questions

- 1 a) Describe the appearance of the copper at the start and the end of the experiment.
b) What happens to the glowing splint when it is treated with the air left at the end of the experiment?
c) Why are glass wool plugs used?
d) Why is the combustion tube cooled at the end of the experiment?
e) Why is it important to use more copper than needed to react with the oxygen in the air?
- 2 Using the information in the table:
 - a) draw a pie chart to show the composition of the air.
 - b) draw a bar chart to show the composition of the air.

Composition of air

gas	percentage by volume
nitrogen	78
oxygen	21
argon	0.9
carbon dioxide	0.03
other gases	0.003
water vapour	variable